Ac 5/2/989

A PILOT'S GUIDE TO

AVIATION WEATHER SERVICES

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service

C 55.108!

This brochure is designed to help you use the NATIONAL AVIATION WEATHER SYSTEM to the fullest extent possible. The information and services are available from the National Weather Service, the Federal Aviation Administration and information service companies. Use it regularly and fly safely.

PRE-FLIGHT

"A.M. WEATHER" telecast on the Public Broadcasting Service (PBS) Television Network is a 15-minute weathercast designed for pilots and is seen Monday through Friday morning. Check TV listing in your area for exact time and station.

Continually updated short-flight forecasts are provided by continuous **Transcribed Weather Broadcast (TWEB)** and the **Pilot's Automatic Telephone Weather Answering Service (PATWAS).**

For longer flights a telephone call or visit to the nearest FAA **Flight Service Station (FASS)** or **NOAA Weather Service Office (WSO)** is necessary. In marginal weather, briefers are busy and telephone delays are common. While you wait, get basic information from TWEB and PATWAS—**but do make the call to the briefer.** Remember that new aviation weather observations from distant stations are normally available by 10 minutes past the hour.

Pilots are able to receive pre-flight weather briefings tailored to their individual flight needs by taking advantage of procedural changes in the weather briefing format. Any one of three types of briefings may be requested: standard, abbreviated or outlook.

The standard briefing should be requested when the pilot has not received any prerecorded or mass media weather information (e.g. PATWAS, TWEB, A.M. WEATHER, etc.). After giving the briefer the type of flight (VFR or IFR), aircraft number, aircraft type, departure airport, route, destination, altitude, ETD, and ETE, the pilot will automatically receive the following:

- adverse conditions
- whether VFR flight is not recommended
- synopsis of prevailing weather systems
- current conditions
- en route forecast
- destination forcast
- winds aloft
- *NOTAMs
- *any expected delays
- any additional information the pilot requested.

* Not available at NOAA Offices

An abbreviated briefing should be requested if the pilot has used prerecorded or mass media weather information to make go/no-go decision. The briefer,

who is aware of what information has been included in these weather broadcasts, will then "fill the gaps" with only the information the pilot has not received (such as forecasts). Again, the pilot should provide the pertinent information about aircraft type, route, etc., tell the briefer just what source he has listened to, and ask for the abbreviated briefing.

For long-range flight planning, the pilot can ask for an outlook briefing-conditions expected six or more hours ahead. Of course, an abbreviated or standard briefing should also be obtained at the time of departure. In-flight weather briefings will folllow the same format.

The briefing procedures are explained in detail in the Airman's Information Manual (purchased on subscription from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.)

FOR YOUR PRE-FLIGHT WEATHER BRIEFING GIVE THE BRIEFER –

1. Type of flight VFR or IFR
2. ACFT Ident or pilot's name
3. ACFT type
4. Departure point
5. Route-of-flight
6. Destination
7. Altitude
8. EST time of departure
9. EST time en route or EST time of arrival

After receiving weather information, either for short or long-range flights, consider carefully whether conditions are suitable for your flight. **If not, delay your flight.**

IN-FLIGHT

Weather information is available by calling any FAA/FSS facility within radio range. Selected FSS's broadcast current weather reports, in-flight advisories, PIREPs, RAREPs, and NOTAMs at 15 minutes past every hour. TWEBs also can be received in the air. **Monitor weather broadcasts routinely and do not hesitate to request specific information from FAA/FSS—En Route Flight Advisory Service (EFAS)—"Flight Watch"—at 122.0 MHz.**

BEFORE LANDING

At many terminals, information helpful to landing and takeoff is continuously broadcast over a navigational aid frequency. Prior to descent, request current weather for terminal area as well as field conditions at destination.

During marginal conditions, keep a particularly close check on en route, terminal, and alternate terminal weather.

TERMINAL FORECASTS contain information for specific airports on expected ceiling, cloud heights, cloud amounts, visibility, weather and obstructions to vision and surface wind. They are issued 3 times/day, amended as needed, and are valid for up to 24 hours. The last six hours of each forecast are covered by a categorical statement indicating whether VFR, MVFR, IFR or LIFR conditions are expected. Terminal forecasts will be written in the following form:

CEILING: Identified by the letter "C"

CLOUD HEIGHTS: In hundreds of feet above the station (ground)

CLOUD LAYERS: Stated in ascending order of height

VISIBILITY: In statute miles except 6+ indicates unrestricted

WEATHER AND OBSTRUCTION TO VISION: Standard weather and obstruction to vision symbols are used

SURFACE WIND: In tens of degrees and knots; omitted when less than 6 knots.

EXAMPLE OF TERMINAL FORECASTS

DCA 221010: DCA Forecasts 22nd of month - valid time 10Z-10Z 10 SCT C18 BKN 5SW- 3415G25 OCNL C8 X 1/2 SW. Scattered clouds at 1000 feet, ceiling 1800 feet broken, visibility 5 miles, light snow showers, surface wind 340 degrees 15 knots gusts to 25 knots, occasional ceiling 8 hundred feet sky obscured, visibility 1/2 mile in moderate snow showers.

12Z C50 BKN 3312G22: By 12Z becoming ceiling 5000 feet broken, surface wind 330 degrees 12 knots gusts to 22 knots.

04Z MVFR CIG: last 6 hours after 04Z marginal VFR conditions due to ceiling.

CATEGORIES	CEILING		VISIBILITY
LIFR	**<500**	**and/or**	**<1**
IFR	**>500-<1000**	**and/or**	**>1-<3**
MVFR	**>1000-≤3000**	**and/or**	**>3-≤5**
VFR	**>3000**	**and**	**>5**

L in LIFR and M in MVFR indicate "LOW" and "MARGINAL".

AREA FORECASTS (FA) are issued for the conterminous United States by the National Aviation Weather Advisory Unit (NAWAU) in Kansas City, Missouri and by National Weather Service Forecast Offices in Alaska and Hawaii.

FA's are 12-hour forecasts plus 6-hour categorical outlooks prepared 3 times/day and are amended as needed. FA's provide a synopsis of the expected weather for 18 hours and, for a 12 hour valid time, provide predictions for icing conditions, turbulence, IFR conditions, areas of mountain obscurement, cloud cover, weather and visibilities. All heights in the FA are referenced in ABOVE MEAN SEA LEVEL (MSL) or ABOVE GROUND LEVEL (AGL). Each IN-FLIGHT ADVISORY affecting an FA area will also serve to amend the FA.

WIND and TEMPERATURE ALOFT FORECASTS are prepared by the National Meteorological Center (call letters WBC) for 176 locations in 48 states. These forecasts are 6, 12, and 24-hour forecasts of wind direction (nearest 10° true N) and speed (knots) for 11 selected flight levels to 53,000 feet. Temperatures aloft (°C) are included for all but the 3000-foot level. Winds and temperatures for in-between points and altitudes can be obtained by interpolation.

FORMAT OF WIND ALOFT FORECAST

FT	3000	6000	9000	etc.
DCA	2925	2833+00	2930-03	etc.

AT 6000 feet MSL wind from 280° at 33° knots with temperature 0° Celsius

IN-FLIGHT ADVISORIES (SIGMET CONVECTIVE SIGMET AND AIRMET) are issued by NAWAU for the conterminous United States. SIGMETS AND AIRMETS are also issued by NWS Forecast Offices in and for Alaska and Hawaii. SIGMET and AIRMET messages broadcast by FAA on NAVAID voice channels warn pilots of potentially hazardous weather. SIGMETS concern severe and extreme conditions of importance to all aircraft such as icing, turbulence, duststorms, sandstorms and volcanic ash episodes. AIRMETS concern less than severe conditions which may be hazardous to some aircraft or pilots. CONVECTIVE SIGMETS are issued for thunderstorms by NAWAU for the conterminous United States.

TRANSCRIBED WEATHER BROADCASTS AND SYNOPSES are route forecasts for a 50-nautical-mile wide zone along a route. Forecast texts are prepared and furnished to FAA for dissemination via the continuous **Transcribed Weather Broadcasts (TWEBs)** over specified low/medium frequency (L/MF) (200-415 KHz) and very high frequency (VOR) (108.0-117.95 MHz) and the **Pilots Automatic Telephone Weather Answering Service (PATWAS).** These texts serve as weather briefings for local or limited cross-country flights. Telephone numbers for PATWAS outlets are in the Airport/Facility Directory.

TWEBs provide continuous weather information usable within receiving range (about 75 miles) and contain Outlet Identification; Synopsis; Flight Precautions; TWEB Route Forecasts; Winds Aloft Forecasts; RAREPs; PIREPs; Surface Weather Reports; NOTAM's. **The TWEB and Weather Outlets by States are listed below.**

VOR Frequencies in MHz have line-of-sight range
NDB Frequencies in Khz have varying ranges.

TWEB Route Configuration Map

En Route Flight Advisory Service

Low Altitude (below FL180)—122.0 MHz
High Altitude (FL180 and above)—see Airport Facility Directory

Navigational Facilities Used for Dissemination of TWEB Information Check Airport Facilities Directory for Currency

ALABAMA
SJI 115.3

ARIZONA
GCN 113.1
ENZ 394
PGO 326
DRK 114.1
RYN 338

CALIFORNIA
ACV 110.2
CEC 109.0
EHF 115.4
DAG 113.2
ILA 114.4
ENI 112.3
EZB 362
CZQ 112.9
FCH 344
FIM 112.5
FJS 109.6
FOT 114.0
GFS 114.4
HNW 115.5
NKX 280.4
OGN 115.3
MYV 110.8
MOG 382
MXW 110.0
MZB 117.8
PBT 338
OCN 115.3
POM 110.4
PRB 114.3
RBL 115.7
SAC 115.2
STS 113.0
SWR 113.2
SAU 116.2
RZS 114.9
ROM 110.0
MQO 112.4
GLT 111.0
SNS 117.3
SOQ 332
VIS 109.4

COLORADO
AP 260
IOC 117.5

DISTRICT OF COLUMBIA
DC 332

FLORIDA
AM 388
JA 344
CKK 365
PKZ 326
TL 379

GEORGIA
BR 266

IDAHO
LWS 108.2

ILLINOIS
DPA 108.4
ME 350

INDIANA
SBN 115.4

KANSAS
ANY 112.9
IC 332

LOUISIANA
GNI 236
SH 230

MAINE
LNT 344

MASSACHUSETTS
HYA 114.7
TUK 194
LQ 382

MICHIGAN
CI 400
MBS 112.9
MQT 116.8
TV 365
TVC 114.6

MINNESOTA
DL 379
FCM 111.8
IN 353
MS 266

MISSOURI
ANX 114.0
MAP 113.4
BUM 115.9
COU 110.2
DO 359
DGD 109.4
IRK 114.6
SFG 116.9

MONTANA
GTF 115.1

NEVADA
BAM 112.2
BQU 114.5
ELY 110.6
MMM 114.3
FMG 117.9
ILC 116.3
LWL 114.2
BLD 116.7
BTY 114.7
HZN 114.1
LLC 116.5
MVA 115.1
OAL 117.7
TPH 117.2
SDO 114.3
SPK 254

NEW JERSEY
GKQ 379

NEW MEXICO
GUP 115.1
ILT 230
RO 305

NEW YORK
BBN 275
CCC 117.2
ELM 375
GEE 108.2
IGN 117.6
UCA 111.2

NORTH CAROLINA
BZM 110.8
EWN 113.6

NORTH DAKOTA
AA 365
BI 230
GFK 114.3
MOT 117.1
OHIO
APE 116.7
CL 344
CM 391

OKLAHOMA
DW 375
RG 350

OREGON
CVO 108.4
DLS 112.3
EUG 112.9
OED 113.6
BKE 115.3
AST 114.0
ONP 117.1
OTH 112.1
PDT 114.7
RBG 108.2
UBG 117.4

PENNSYLVANIA
MKP 287
CIP 112.9
LHY 110.8
PTW 116.5
RAV 114.6

SOUTH DAKOTA
FS 245
MON 117.6
PIR 112.5

TEXAS
AM 251
EL 242
FT 365
GLS 206
LBB 109.2
MA 326
SPS 112.7

VIRGINIA
HPW 112.0

WASHINGTON
YKM 116.0
HQM 117.7
EPH 112.6
BLI 113.0
BTG 116.6
OLM 113.4
PAE 114.2
PSC 108.4
PUW 109.0
SEA 116.8
TOU 112.2
ALW 116.4
NUW 280.3
EAT 111.0
ELN 117.9
MWH 115.0

WEST VIRGINIA
MRB 112.1
SSU 108.4
RNL 116.6

WYOMING
MDM 116.2
OCS 114.7

WISCONSIN
BAE 116.4
GM 242

Contractions

NATIONAL WEATHER SERVICE FORECAST TERMS

ACFT	aircraft
ACTV	active
AGL	above ground level
ALF	aloft
AMS	air mass
ARND	around
ASL	above sea level
BKN	broken
BLZD	blizzard
BRF	brief
BTWN	between
BTR	better
BYD	beyond
CAT	clear air turbulence
CAVOK	cloud and visibility OK
CHG	change
CIG	ceiling
CONT	continue
CSDRBL	considerable
CVR	cover
DCR	decrease
DMSH	diminish
DNS	dense
DRZL	drizzle
DSIPT	dissipate
DVLP	develop
EMBDD	embedded
EXTRM	extreme
EXTSV	extensive
FCST	forecast
FLRY	flurry
FQT	frequent
FROPA	frontal passage
FROSFC	frontal surface
GNDFG	ground fog
GRDL	gradual
HGT	height
HLSTO	hailstones
HND	hundred
HURCN	hurricane
HVY	heavy
ICGIC	icing in clouds
ICGIP	icing in precipitation
IMDT	immediate
INCR	increase
INDEF	indefinite
INTSFY	intensify
ISOLD	isolated
JTSTR	jet stream
KT	knot (s)
LGT	light
LMT	limit
LVL	level
LWR	lower
LYR	layer
MDT	moderate
MRTM	maritime
MSL	mean sea level
MXD	mixed
NM	nautical mile (s)
NMRS	numerous
NOTAM	notice to airmen
OBSC	obscure
OCLN	occlusion
OCNL	occasional, occasionally
OCR	occur
OTLK	outlook
OTRW	otherwise
OVC	overcast
PCPN	precipitation
PIREP	pilot report
PRST	persist
PBL	probable
PSBL	possible
PSG	passing, passage
PTLY	partly
PVL	prevail
RAREP	radar weather report
RESTR	restrict
RDG	ridge
RGD	rugged
RMN	remain
RPD	rapid
RTE	route
RUF	rough
SCT	scattered
SCTR	sector
SHFT	shift
SHWR	shower
SKC	sky clear
SLGT	slight
SMK	smoke
SNW	snow
SQLN	squall line
STBL	stable
STG	strong
SVR	severe
THN	thin
TSHWR	thunder shower
TSTM	thunder storm
TURBC	turbulence
TWD	toward
UPSLP	up slope
VRBL	variable
VSBY	visibility
WDLY	widely
WEA	weather
WK	weak
WY	wave
WX	weather

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(Rev. 1989)

Key to Aviation Weather Observations

LOCATION IDENTIFIER TYPE AND TIME OF REPORT	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA-LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	REMARKS AND CODED DATA
MCI SA 0758	15 SCT M25 OVC	IR-F	132	/58/56	/1807	/993/	RO1VR20V40

SKY AND CEILING

Sky cover contractions are in ascending order. Figures preceding contractions are heights in hundreds of feet above station.

Sky cover contractions are:

CLR	Clear: Less than 0.1 sky cover.
SCT	Scattered: 0.1 to 0.5 sky cover.
BKN	Broken: 0.6 to 0.9 sky cover.
OVC	Overcast: More than 0.9 sky cover.
—	Thin (When prefixed to SCT, BKN, OVC).
— X	Partly obscured: 0.9 or less of sky hidden by precipitation or obstruction to vision (bases at surface).
X	Obscured: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface).

Letter preceding height of layer identifies ceiling layer and indicates how ceiling height was obtained. Thus:
E Estimated; **M** Measured; **W** Vertical visibility into obscured sky. **V** Immediately following height, indicates a variable ceiling.

VISIBILITY

Reported in Statute miles and fractions. (V = Variable)

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

A	Hail	**SG**	Snow grains
BD	Blowing dust	**SP**	Snow pellets
BN	Blowing sand	**SW**	Snow showers
BS	Blowing snow	**T+**	Severe thunderstorms
D	Dust	**T**	Thunderstorm
F	Fog	**ZL**	Freezing drizzle
GF	Ground fog	**ZR**	Freezing rain
H	Haze	**K**	Smoke
IC	Ice crystals	**L**	Drizzle
IF	Ice fog	**R**	Rain
IP	Ice pellets	**RW**	Rain showers
IPW	Ice pellet showers	**S**	Snow

Precipitation intensities: — Light; (no sign) Moderate; + Heavy.

WIND

Direction in tens of degrees from true north, speed in knots. 0000 indicates calm. G indicates gusty. Peak speed of gusts in the past ten minutes follows G or Q when gusts or squall are reported. The contraction WSHFT followed by UTC time group in remarks indicates windshift and its time of occurrence.

EXAMPLES: 3627 = 360 Degrees; 27 knots; 3627G40 = 360 Degrees, 27 knots, peak speed in gusts 40 knots.

ALTIMETER SETTING

The first figure of the actual altimeter setting is always omitted from the coded report.

RUNWAY VISUAL RANGE (RVR)

RVR is reported for some stations. Extreme values during 10 minutes prior to observation and based on runway light setting 5 are given in hundreds of feet. Runway identification precedes RVR report.

DECODED REPORT

Kansas City International Airport: Record observation taken at 0758UTC. 1500 feet scattered clouds, measured ceiling 2500 feet overcast, visibility 1 mile, light rain, fog, sea-level pressure 1013.2 millibars, temperature 58°F, dewpoint 56°F, wind 180°, 7 knots, altimeter setting 29.93 inches. Runway 01 visual range 2000 feet lowest, 4000 feet highest in the past 10 minutes.

TYPE OF REPORT
SA—as scheduled record observation.
SP—an unscheduled special observation indicating a significant change in one or more elements.
RS—a scheduled record observation that also qualifies as a special observation. The designator for all three types of observations (SA, SP, RS) is followed by a 24-hour clock-time-group in UTC.

THE IMPORTANCE OF PIREPs

How can you help eliminate, or at least reduce en route weather surprises? The best way is to fill-in the few-and-far-between surface weather observations—with your PIREPs.

A PIREP gives valuable information on what pilots actually experience in-flight, in contrast to the data a weather observer measures or estimates on the ground.

Here's an example of encoded and decoded PIREPs showing the wealth of data a pilot can give and receive.

ENCODED

UA/OV FRR 275045/TM 1745/FL330/TP B727/SK 185 BKN 220/280 BKN 310/TA-53/WV 290120/TB LGT-MDT CAT ABV 310

DECODED

Pilot report, Front Royal VORTAC 275 radial 45 nm, at 1745Z, flight level 33000; Boeing 727; cloud base 18500 broken, tops 22000, second layer 28000 broken tops 31000; air temperature minus 53 degrees Celsius; wind 290 degrees 120 knots; light to moderate clear air turbulence above 31000.

Conversion Tables

TIME

STANDARD TO UTC

Eastern	+5 hr	= UTC
Central	+6 hr	= UTC
Mountain	+7 hr	= UTC
Pacific	+8 hr	= UTC
Yukon	+9 hr	= UTC
Alaskan	+10 hr	= UTC
Bering	+11 hr	= UTC

Add one less hour for Daylight Time.

WINDSPEED

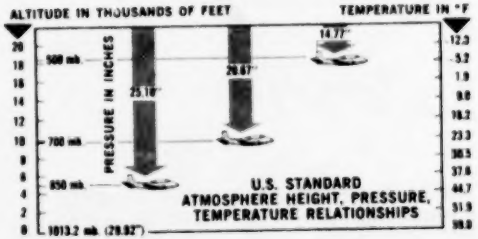
MPH	Knots
1-2	1-2
3-8	3-7
9-14	8-12
15-20	13-17
21-25	18-22
26-31	23-27
32-37	28-32
38-43	33-37
44-49	38-42
50-54	43-47
55-60	48-52
61-66	53-57
67-71	58-62
72-77	63-67
78-83	68-72
84-89	73-77
119-123	103-107

Knots x 1.15 = Miles Per Hour
Miles Per Hour x 0.869 = Knots

Pressure and Altimeter

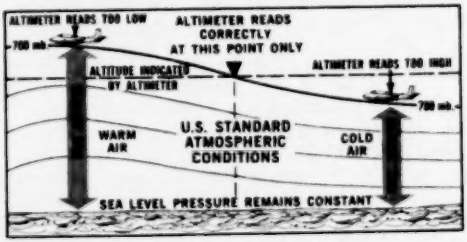
U.S. STANDARD ATMOSPHERE

In these features of the U.S. Standard Atmosphere, note uniform changes of temperature with height as shown on right margin. At 18,000 feet, air pressure is approximately half the sea-level pressure.

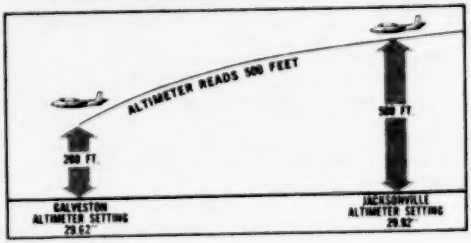


ALTIMETERS

The altimeter reading is too high when the air is colder, and too low when the air is warmer than the U.S. Standard Atmosphere.



The true height of the airplane changes when the surface pressure changes if the pilot flies at a constant indicated altitude and does not reset his altimeter.



Reporting Turbulence

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	Turbulence that momentarily causes slight erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as Light Turbulence.* **or** Turbulence that casues slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as Light Chop.	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional—Less than ⅓ of the time. Intermittent—⅓ to ⅔. Continuous—More than ⅔.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as Moderate Turbulence.* **or** Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as Moderate Chop.	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	**NOTE** 1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. EXAMPLES: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as Severe Turbulence.*	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violent tossed about and is practically impossible to control. It may cause structural damage. Report as Extreme Turbulence.*		

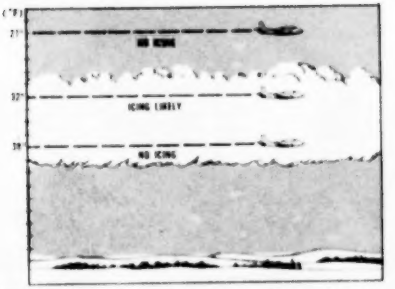
* High level turbulence (normally above 15,000 feet MSL not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (Clear Air Turbulence) preceded by the appropriate intensity, or light or moderate chop.

Reporting Airframe Icing

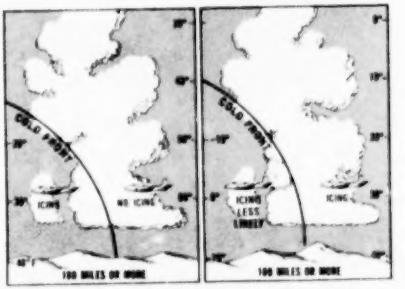
INTENSITY	ICE ACCUMULATION
Trace	Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing / anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).
Light	The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary. APPROVED SC/AMS Meeting 4/68.
Moderate	The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/ anti-icing equipment is used.
Severe	The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/ anti-icing equipment or diversion is necessary.

*Rime Ice. Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.
Clear Ice. A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

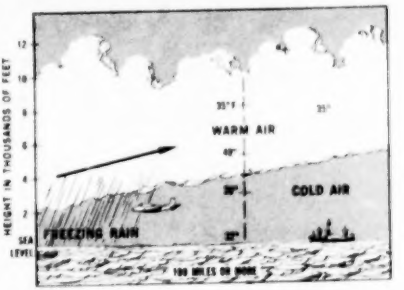
Icing Conditions



Ice forms when temperature is below freezing and there is a visible moisture.



Probable icing conditions in these two examples of cold fronts are dissimilar because the airmass with much lower temperatures is more likely to contain ice crystals than liquid water droplets.



Example of freezing rain under a warm front.